

REMARKS

Claims 1-3, 6-25, 27, and 38-42 are pending in the application. Claim 40 is amended. No new matter has been added by virtue of the amendments, support being found throughout the specification and claims.

1. Claim Objections

Claims 40-42 are objected to. Claim 40 has been amended as suggested to correct its dependency from claim 1 rather than canceled claim 37.

2. 35 U.S.C. § 103(a) Rejections

Judd, Lauffer, Berg, and Foo

Claims 1-3, 6, 7, 9, 12-22, 24, and 37-39 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,910,112 to Judd et al (hereinafter "Judd"), U.S. Patent No. 5,628,982 to Lauffer et al (hereinafter "Lauffer"), U.S. Patent No. 5,128,121 to Berg et al. (hereinafter "Berg"), and U.S. Patent Application No. 2002/0087067 to Foo (hereinafter "Foo"). Applicants respectfully traverse.

Applicants teach a method for ^{23}Na and ^{39}K MRI of cardiac tissue that addresses resolution problems associated with current imaging techniques. In particular, ^{23}Na imaging can be used to detect altered sodium levels. Sodium levels of nonviable myocardium are elevated after acute infarction and reperfusion due to the impaired sodium-potassium pump function. However, it has been found that ventricular blood in the heart has a particularly high sodium content and, thus, the elevated sodium levels of infarcted myocardial tissue are difficult to distinguish. Applicants have unexpectedly found that elevated sodium levels of infarcted myocardial tissue can be distinguished by administering a contrast agent so as to reduce or null the sodium blood signals. Applicants further found that the quantity of contrast agent and echo time (TE) can further be selected to so as to provide even better results.

Judd describes methods to increase the overall ^{23}Na and ^{39}K imaging signals by increasing voxel size, lengthening imaging time, using fast imaging pulse sequences, and selecting proper receiver bandwidth.

As acknowledged by the Office, Judd does not teach the use of an iron oxide contrast agent so as to attenuate (i.e., reduce) the ^{23}Na or ^{39}K MRI signal for ventricular cavity blood and viable well-perfused tissue. In fact, Judd is not at all directed to the use of contrast agents. Further, Judd is not at all related to attenuating (reducing) the ^{23}Na or ^{39}K MRI signal as set forth in Applicants' claims. Rather, Judd is directed towards the opposite - methods to increase overall ^{23}Na signals by about 22,000 and ^{39}K signals by about 2.1 million (see col. 5, lines 47-64).

The Office points to Berg as allegedly teaching a "method of improving the contrast in MRI images by using a ferromagnetic or paramagnetic contrast agent such as an iron oxide bound to a polysaccharide" and asserts that it would have been obvious to modify Judd to "include the use of iron oxide to attenuate the ^{23}Na or ^{39}K MRI signal for ventricular cavity blood and viable well-perfused tissue". Applicants respectfully disagree.

Applicants respectfully submit that there is no teaching, suggestion, or motivation to modify Judd's method, which is specifically directed towards increasing overall ^{23}Na and ^{39}K signals by 22,000 and 2.1 million respectively, so as to do the opposite which is to reduce ^{23}Na or ^{39}K MRI signals in particular tissues. Thus, it is respectfully submitted that there is no teaching or suggestion to modify and combine the Judd and Berg references as proposed by the Office.

Moreover, Berg describes the use of a combination of both positive and negative contrast agents to enhance tissue or organ visualization in MRI. Berg does not teach or suggest the use of the positive and negative contrast agents with ^{23}Na or ^{39}K MRI imaging in particular. Further,

Berg does not teach or suggest the use of one particular contrast agent (e.g. iron), but rather teaches the use of a combination of both positive and negative contrast agents.

As set forth above, Applicants have specifically discovered methods for ^{23}Na and ^{39}K MRI imaging of the heart wherein problems associated with altered sodium and potassium levels after acute infarction and reperfusion (due to the impaired sodium-potassium pump function) are addressed. This is not taught or suggested by the cited references but, rather, comes from Applicants' disclosure.

Thus, it is respectfully submitted that not only is there no teaching or suggestion to combine and modify Judd and Berg as proposed by the Office, but also that even if Judd and Berg were combined, Applicants' invention still would not be taught or suggested.

The Office further acknowledges that Judd and Berg do not teach the use of a contrast agent before manipulating echo time. However, the Office points to Lauffer and asserts that Lauffer describes adjusting imaging parameter values after the administration of contrast agent (citing C25, L45-60).

Lauffer describes nuclear magnetic resonance ("NMR") imaging. However, like Judd and Berg, Lauffer does not teach or suggest Applicants' claimed methods of ^{23}Na or ^{39}K MRI wherein an iron oxide contrast agent is used so as to reduce the ^{23}Na or ^{39}K MRI signal for ventricular cavity blood and viable well-perfused tissue. None of these cited references teach or suggest the use of iron oxide contrast agent in connection with ^{23}Na and ^{39}K MRI imaging of the heart so as to address problems associated with altered sodium and potassium levels after acute infarction and reperfusion.

Thus, it is respectfully submitted that there is no teaching or suggestion to combine and modify Judd, Berg, and Lauffer as proposed by the Office (for the reasons set forth above), but

also that even if Judd, Berg, and Lauffer were combined, Applicants' invention still would not be taught or suggested.

The Office further acknowledges that Judd, Berg, and Lauffer do not teach providing a contrast between the ventricular cavity and infarcted myocardial tissue. However, the Office further points to Foo as allegedly describing a method of providing a contrast between ventricular cavity and infarcted tissue.

Foo describes methods for imaging wherein a pulse sequence having a slice-selective inversion RF pulse designed to suppress myocardial tissue is used in combination with a notched inversion RF pulse designed to suppress blood pool. Like Judd, Berg, and Lauffer, Foo does not teach or suggest Applicants' claimed methods of ^{23}Na or ^{39}K MRI wherein an iron oxide contrast agent is used so as to reduce the ^{23}Na or ^{39}K MRI signal for ventricular cavity blood and viable well-perfused tissue. None of the cited references teach or suggest the use of iron oxide contrast agent in connection with ^{23}Na and ^{39}K MRI imaging of the heart so as to address problems associated with altered sodium and potassium levels after acute infarction and reperfusion.

Thus, it is respectfully submitted that there is no teaching or suggestion to combine and modify Judd, Berg, Lauffer, and Foo as proposed by the Office (for the reasons set forth above), and also that even if Judd, Berg, Lauffer, and Foo were combined, Applicants' invention still would not be taught or suggested.

Thus, claims 1 and 16 are patentable over Judd, Berg, Lauffer, and Foo. Claims 2, 3, 6-15, 38, and 40-42 depend from claims 1 and 16 and, thus, also are patentable over Judd, Berg, Lauffer, and Foo. Reconsideration and withdrawal of the rejection is respectfully requested.

Judd, Lauffer, Berg, Foo, and Weissleder

Claims 8, 10-11, 23, 25, and 27 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Judd, Berg, Lauffer, Foo, and U.S. Patent No. 5,492,814 to Weissleder (hereinafter "Weissleder"). Applicants respectfully traverse.

As set forth above, claims 1 and 16 are patentable over Judd, Berg, Lauffer, and Foo. Weissleder is cited for the alleged use of specific types of iron oxide contrast agents. However, like Judd, Berg, Lauffer, and Foo, Weissleder at least does not teach or suggest Applicants' claimed methods of ^{23}Na or ^{39}K MRI wherein an iron oxide contrast agent is used so as to reduce the ^{23}Na or ^{39}K MRI signal for ventricular cavity blood and viable well-perfused tissue. None of the cited references teach or suggest the use of iron oxide contrast agent in connection with ^{23}Na and ^{39}K MRI imaging of the heart so as to address problems associated with altered sodium and potassium levels after acute infarction and reperfusion.

Thus, there is no teaching or suggestion to combine and modify Judd, Berg, Lauffer, Foo and Weissleder as proposed by the Office (for the reasons set forth above), and also that even if Judd, Berg, Lauffer, Foo, and Weissleder were combined, Applicants' invention still would not be taught or suggested.

Thus, claims 1 and 16 are patentable over Judd, Berg, Lauffer, Foo, and Weissleder. Claims 8, 10-11, 23, 25, and 27 depend from claims 1 and 16 and, thus, also are patentable over Judd, Berg, Lauffer, Foo, and Weissleder. Reconsideration and withdrawal of the rejections is respectfully requested.

CONCLUSION

In view of the forgoing, Applicants believe the pending application is in condition for allowance. Early and favorable action is requested.

If for any reason a fee is required, a fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge Deposit Account No. **04-1105**.

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Respectfully submitted,

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